



“Friction Reduction for Microhole Coiled Tubing Drilling”

Contract No. DE-FC26-05NT15485

**Microhole Integration Meeting
Houston, Texas
November 16, 2005**

**Ed Smalley
V.P. Business Development**



Today's Highlights

Friction Reduction for Microhole CT Drilling

- **Project Overview**
- **Progress Update Since August, 2005**
- **Next Steps**

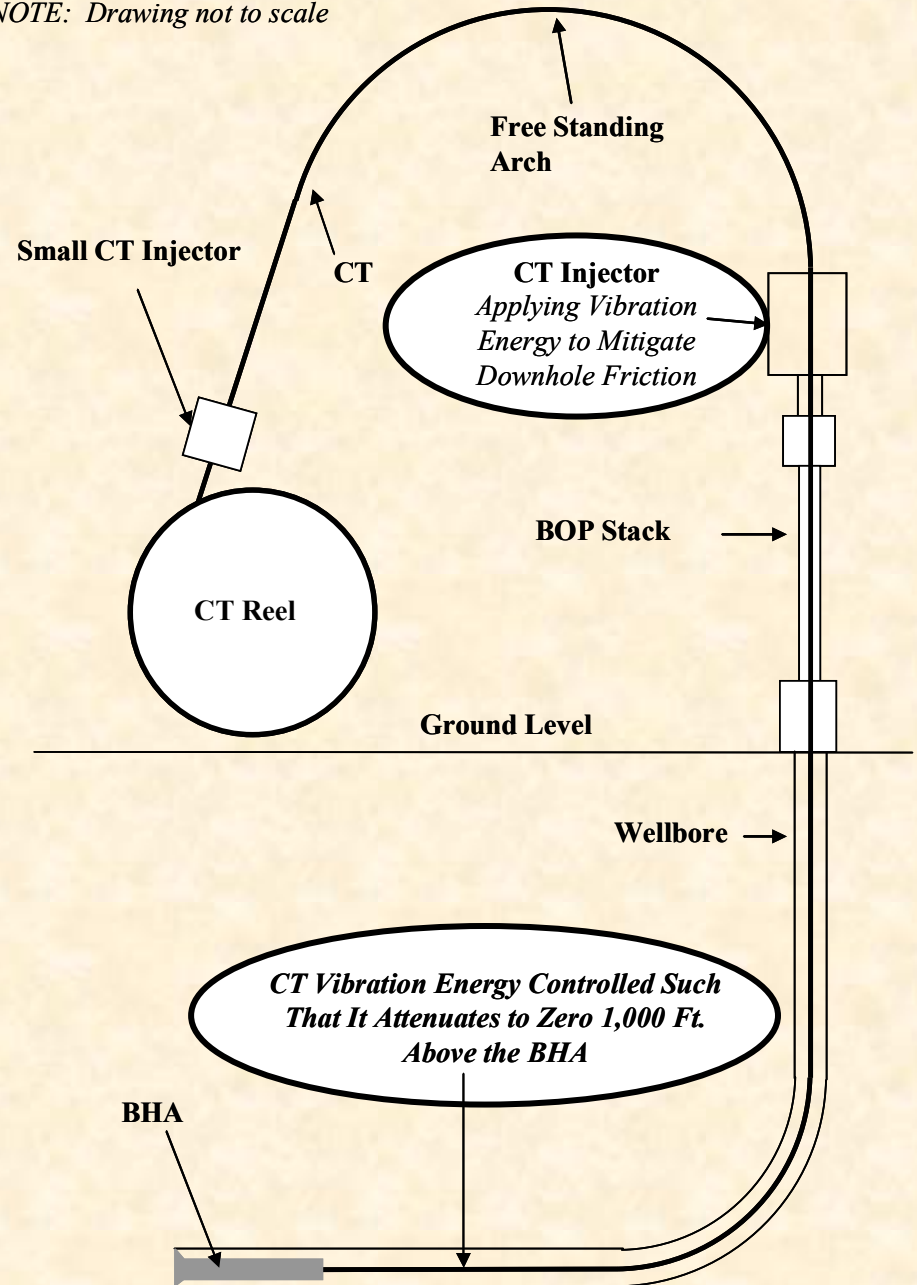


Project Overview

- **Objective:** Develop a Robust, Low-cost System to Mitigate Friction for Microhole CTD
 - Enable Microhole CTD to be utilized for long (3,000') horizontal sections
 - Eliminate the need for a downhole tractor/vibrator
- **Project Duration:** 24 months
 - Currently in month 10 of the project
 - Go/No @ conclusion of Phase 1 (month 12)

Microhole CTD Friction Reduction in Horizontal Wellbores

NOTE: Drawing not to scale





Project Deliverables

Phase 1 (month 1-12)

- **CTD Vibration Propagation Model**
 - Attenuation
- **Vibration Test Fixture**
- **Validation of Model**
- **Conceptual Design of Surface Equipment**
- **Phase 1 Report**
 - Technology Transfer

Phase 2 (month 13-24)

- **Design Surface Equipment**
- **Fabricate Surface Equipment**
- **Component Testing of Surface Equipment**
- **Field Test Surface Equipment**
- **Phase 2/Final Report**
 - Technology Transfer



Progress Since August, 2005

Friction Reduction for Microhole CT Drilling

- **Fabrication of Vibration Test Fixture**
 - “Simulated Wellbores”
 - “Split” CT reel
 - Microhole CT drilling strings
 - Data acquisition system
 - Basic system operation verified
 - CT Data acquired without vibration



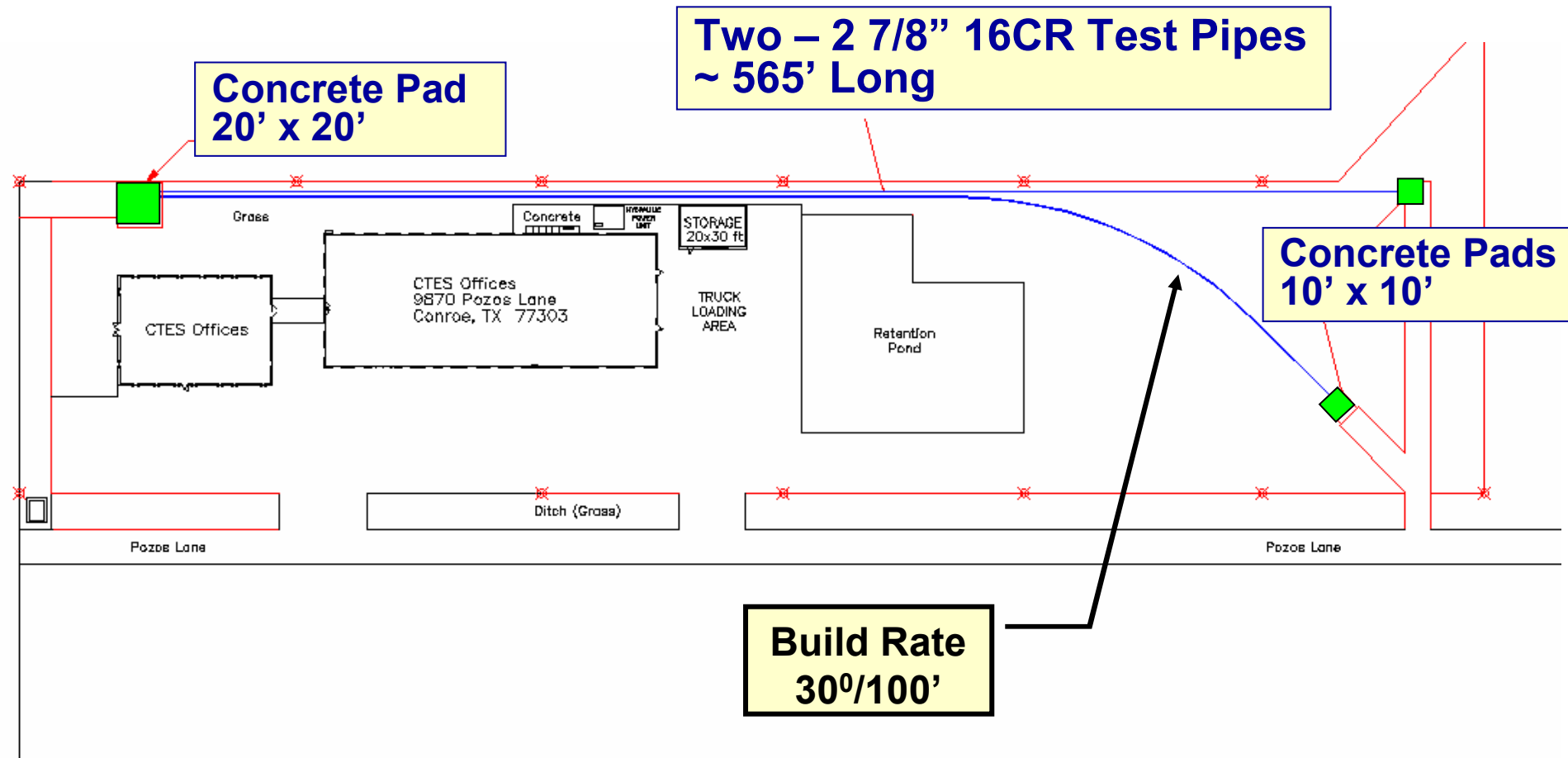
Background:

Vibration Test Fixture

- **Validation of Vibration Propagation Model**
- **Simulate Extreme Downhole Friction Effects for Horizontal CTD**
 - Long length of 2-7/8" pipe for simulated horizontal wellbore, both ends accessible
 - Smaller CT strings (1" & 1-1/2") inserted
 - Sensors at each end of the simulated wellbore
 - "Surface" end of CT vibrated with varying amplitude, frequency and applied axial load



Schematic: Vibration Test Fixture





Simulated Wellbore Installation





Simulated Wellbore Installation





Vibration Test Fixture

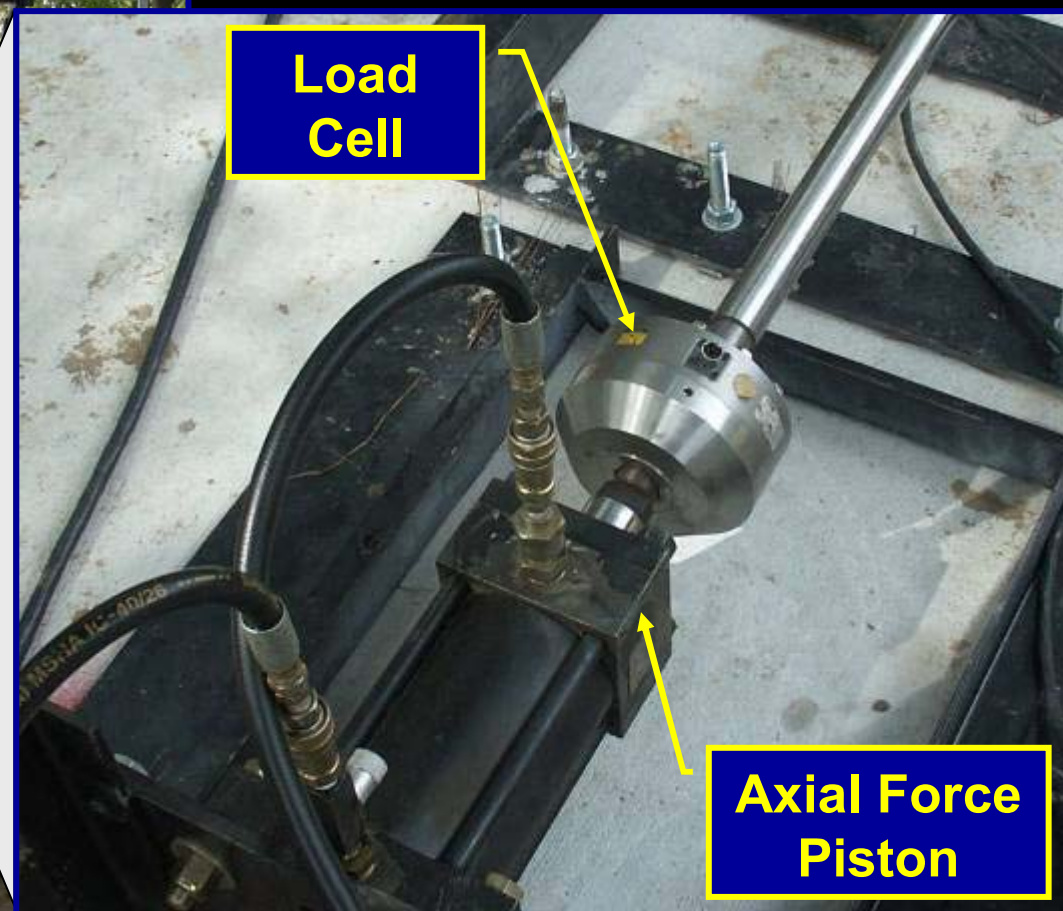
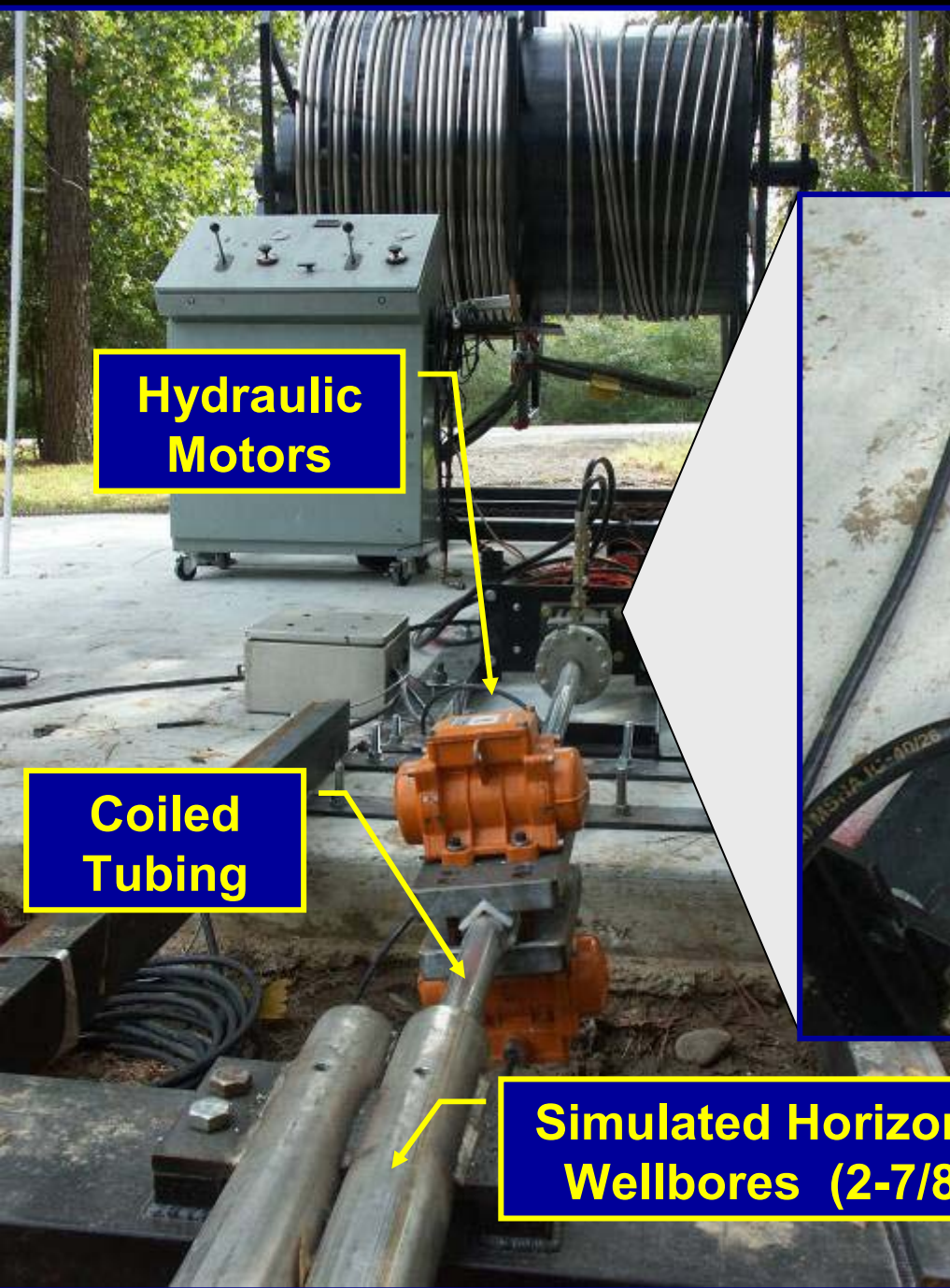
**Friction Mitigation Tests
Software Model Validation**



Vibration Test Fixture

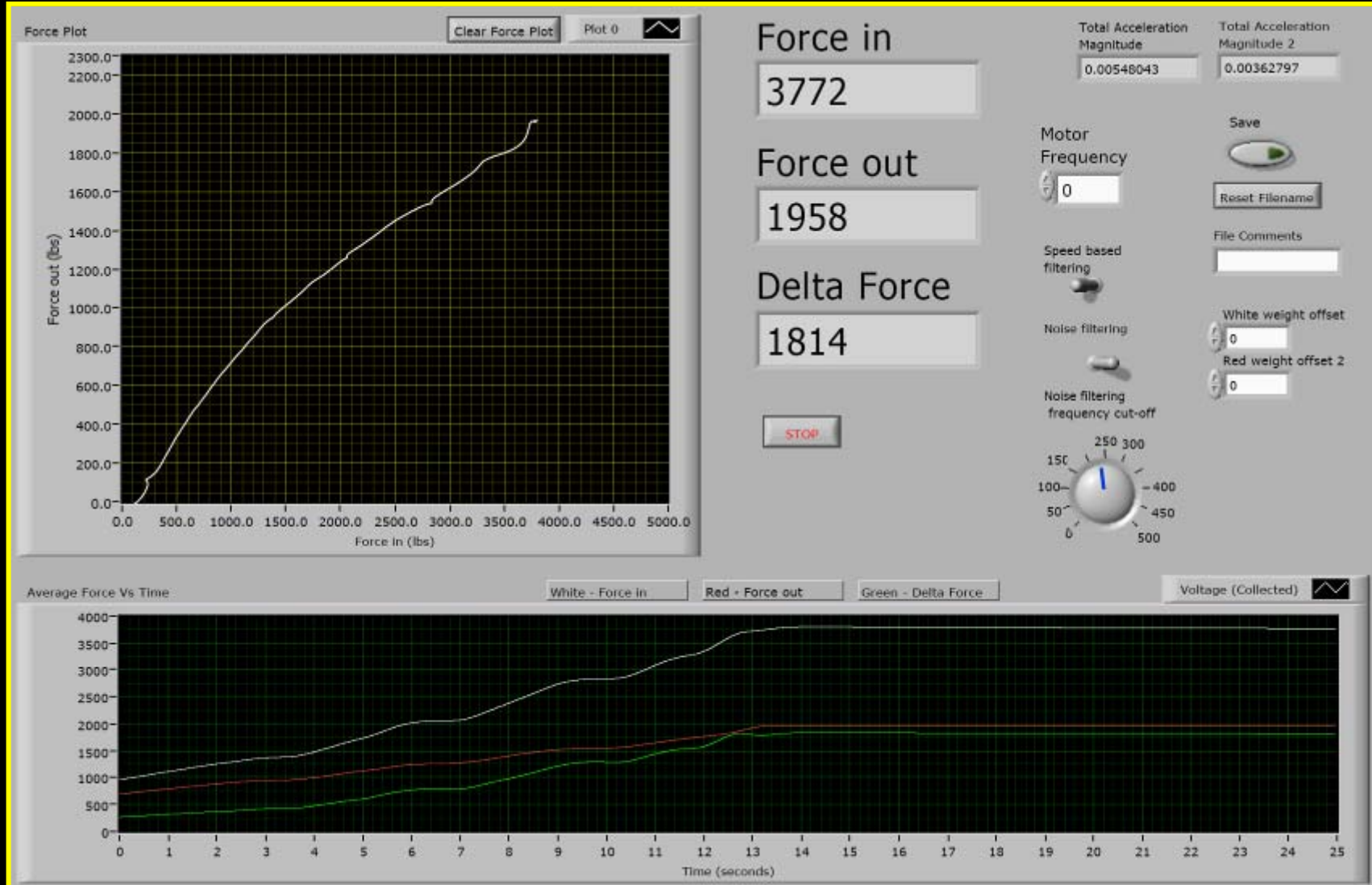
Split CT Reel on Test Pad







Vibration Test Fixture Data Acquisition System

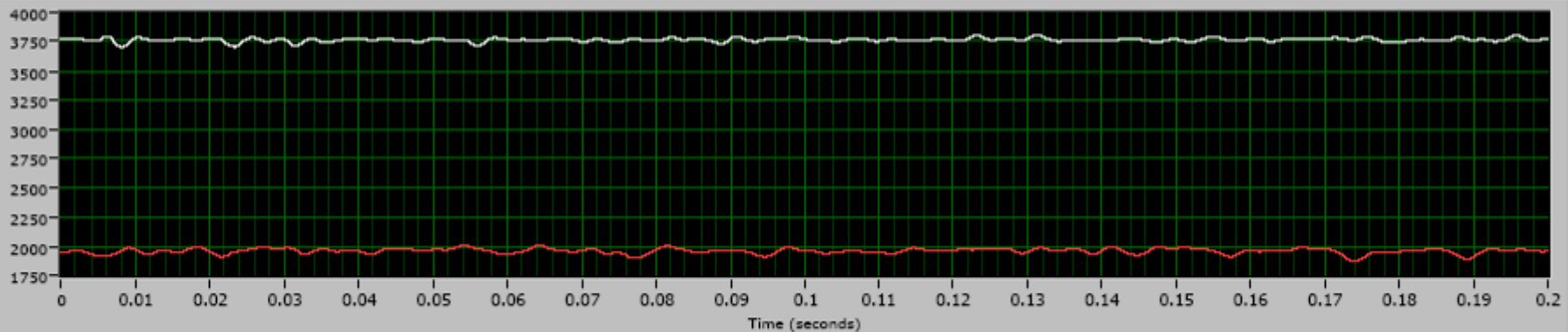




Detailed Data Analysis

Instantaneous Force and Accelerometers

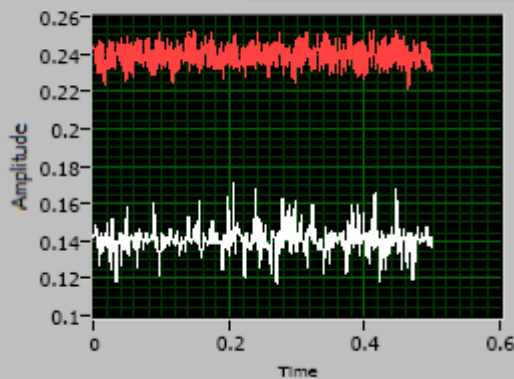
Instantaneous Force Vs Time



Accelerometer Data

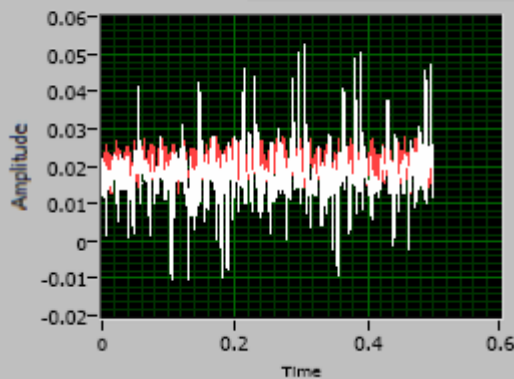
X Axis

Voltage0 (Collected)



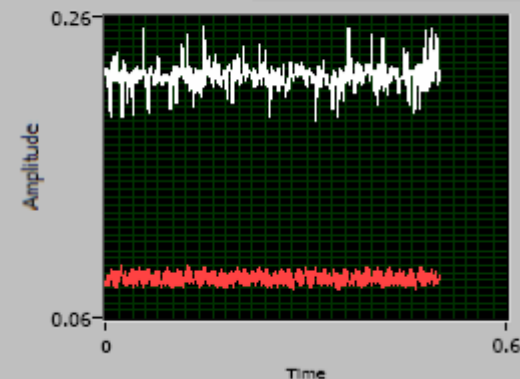
Y Axis

Voltage2 (Collected)



Z Axis

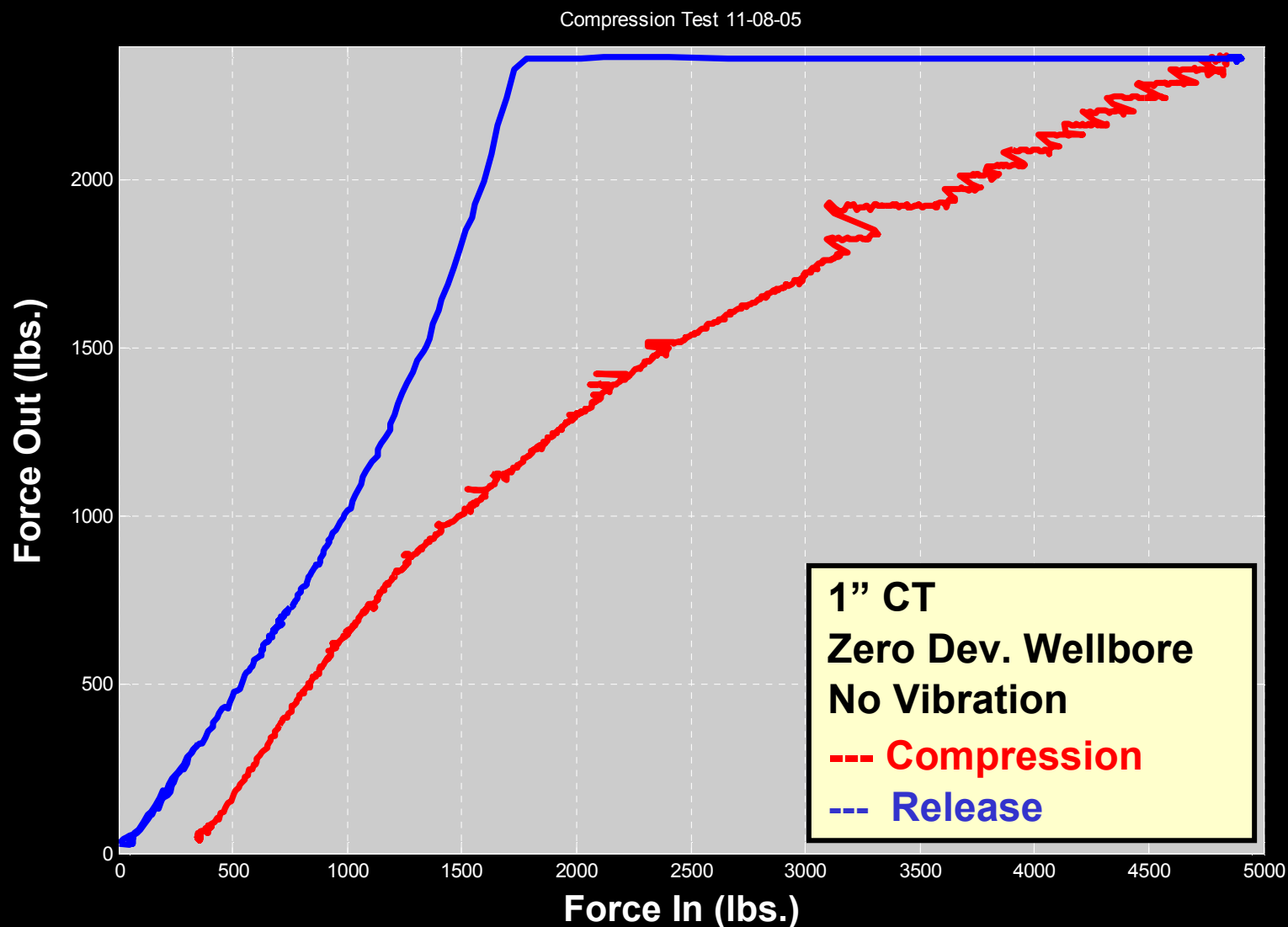
Voltage1 (Collected)





Vibration Test Fixture

Data: No Vibration





Future Activities & Milestones

Friction Reduction for Microhole CT Drilling

- **Vibration Test Fixture Refinements**
- **Initiate CT Tests with Vibration (friction)**
- **Validate Vibration Attenuation Model**
- **Identify Appropriate Vibration Mode for Friction Reduction**
- **Conceptual Design of Vibration Equipment**



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